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## Aortic Regurgitation in a Study of Aged Males with Previous Syphilis

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Summary

For the first time in nearly four decades, aortic regurgitation and cardiovascular morbidity occur equally in the 127 surviving syphilitic and control subjects of the long-continuing Tuskegee Study of untreated syphilis. When examined in 1968 to 1970, two of the living 76 syphilitics and two of 51 controls manifested findings of aortic regurgitation. All but one of the syphilitic survivors have received some amount of antiluetic therapy. Either stability or improvement of subsequent clinical courses followed therapeutic administration of penicillin to the two subjects with syphilitic aortic valvular disease. Autopsy evidence of gross and/or microscopic aortitis has continued to preponderate in the deceased syphilitic subjects as compared to the controls, but the frequency of focal myocardial scarring has been equal in the two groups at post-mortem examination.

### Introduction

Aortic regurgitation (AR) presenting in older patients has frequently resulted from syphilis (1), although the frequency of both clinical (2) and postmortem (3) syphilitic aortic regurgitation has been declining in the United States. A unique opportunity to follow the course of untreated syphilis and aortic valvular disease has existed in the "Tuskegee Study" of untreated syphilis. Initiated nearly four decades ago in Tuskegee, the county seat of Macon County, Alabama, by the U.S. Public Health Service, this study was proposed to determine the incidence of long-term complications of untreated syphilis in the Negro male.

In the 1920's, Bruusgaard had demonstrated from the Oslo Study that untreated syphilis in Caucasians was more pathogenic for men than women, as men developed life-threatening central nervous system and cardiovascular syphilis in a two to one predominance over women (4). Furthermore, postulates had been proposed prior to the Tuskegee Study suggesting that syphilis ran a more fatal course in Negroes (5). Therefore, the original Tuskegee Study subjects were 611 Negro men--410 with a previous history of syphilis and 201 age-matched controls with no clinical or serologic evidence of syphilis. At approximately five year intervals, follow-up clinical and laboratory evaluations of these men have been conducted. The following is a report of the cardiovascular findings observed during the most recent survey extending from 1968 to 1970.

### Methods

Of the 625\* original participants in this study, 127 were located and examined in the two year time period (1968-1970). Four hundred thirteen (66 percent) of the study participants are now dead, and since many of the 63 (23 percent) lost to follow-up would be nonagenarians or older, most are presumed to be dead. The large majority (84 percent) of those recently surveyed had last been examined by study physicians as late as 1963 or 1966. However, special efforts were made to find and examine

\* Includes 14 added at the time of the second examination (1959).

all possible patients. Seven participants who had not been located since their initial selection and examination in 1932 to 1934 were seen.

Of the 127 patients examined, 114 (90 percent) were found in Macon County or in adjacent Russell and Bullock Counties. Other patients, however, were examined in the following cities: three each in Gary, Indiana, and Cleveland, Ohio; and one in East Chicago, Indiana; Chicago, Illinois; Lima, Ohio; Dayton, Ohio; Atlanta, Georgia; East Gadsden, Alabama; and Birmingham, Alabama. Examinations consisted of medical history and physical examination, electrocardiogram, chest x-ray in most patients, serologic tests, and rarely lumbar puncture. These procedures were generally performed in the Macon County Health Department or other local health department facilities, although by necessity, 26 examinations (20.5 percent) were performed at the homes of the subjects. In these latter cases, chest x-rays were often not obtained. Blood specimens were tested at the Venereal Disease Research Laboratory (V.D.R.L.), National Communicable Disease Center, and results were obtained by the VDRL, Automated Reagins, Treponema Pallidum Immobilization (TPI), and Fluorescent Treponemal Antibody Absorption (FTA-ABS) Tests.

In order to further evaluate the entire study group, the records of 229 autopsied subjects were reviewed for evidence of aortitis and myocardial scarring. One hundred sixty-six (72.5 percent) were syphilitics and the remaining 63 (27.5 percent) were controls. Criteria of microscopic syphilitic aortitis were (6): 1) gross thickening of the aortic wall; 2) medial necrosis; 3) adventitial fibrosis; 4) medial scarring; 5) intramural perivascular infiltration; 6) thickened vasa vasorum; and 7) adventitial perivascular infiltration. Signs of macroscopic aortitis due to syphilis included linear strictures of the thoracic aorta, subintimal pearly white scarring, diminution of elasticity of the aorta, fusiform dilatation, saccular aneurysm, and valvular changes in the cusps and commissures of the aortic valve.

Antimicrobial and antisyphilitic treatment histories were obtained from a patients during each survey throughout the years. In order to avoid bias, the previous classification, treatment status, or previous findings of any of the located subjects were not revealed to examiners until the study was completed.

### Results

Of those examined, 76 (17.4 percent of the total syphilitics\*) had previous clinical, serologic, or historical evidence of syphilis. The other 51 males (27.0 percent of the total controls) had no positive syphilitic anamnesis. The median age of the 76 patients with syphilis was 69 years with a range of 52 to 91. The median age of the 51 controls was 70.5 years with a range of 62 to 89. All but one of the originally untreated syphilitics seen in 1968 to 1970 have received therapy, although heavy metals and/or antibiotics were given for a variety of reasons by many nonstudy physicians and not necessarily in doses considered curative for syphilis.

Aggregate findings from the clinical histories, physical examinations, chest x-rays and electrocardiograms from this survey showed that there was no significant statistical difference in cardiovascular morbidity between the two groups of subjects. Syphilitics noted more orthopnea, palpitations, and chest pains than controls, and by examination, the former exhibited more clinical cardiomegaly and abnormal pulses (referring to both qualitative changes and rhythm disturbances). Syphilitics further had more tortuosity and elongation of the thoracic aorta and calcification of the ascending aorta by x-ray and more infarction patterns and conduction disturbances by electrocardiography. However, all of these slight differences showed no consistent trend of increased morbidity between the two groups.

An aortic diastolic murmur was noted in five subjects. One of the five at age 84 was found to have a harsh basal systolic murmur and other clinical signs of aortic stenosis. At autopsy, this subject (#A-10) had classic findings of calcific aortic

\* During the course of the study, total syphilitic and control populations were adjusted, as 12 original controls either acquired syphilis or were found to have reactive treponemal tests (unavailable prior to the 1953 survey).

stenosis. Aortic regurgitation was clinically predominant in the four surviving subjects, whose clinical courses are summarized in Table I. The transmission and associated clinical findings of aortic regurgitation in all four patients were not inconsistent with syphilitic aortic regurgitation. The later realization that two of the involved patients were controls without any evidence of syphilis was totally unexpected. Ironically the subject (#405) with the most marked clinical evidence of aortic regurgitation including head nod and capillary pulsations of the nail beds was a control.

Selected leads from electrocardiograms, phonocardiograms, external pulse pressure recordings, and chest x-rays of the four living patients with aortic regurgitation are presented in Figures 1 to 3. During the three month period between the initial examination and the phonocardiographic pulse pressure recordings from a control patient (#603), there was considerable clinical deterioration with drop in blood pressure and increase in congestive heart failure. The intensity of the patient's AR murmur reduced from Grade III/VI to I/VI but was still detected phonocardiographically.

Comparison of the clinical pictures of the four subjects with aortic regurgitation shows that recent clinical deterioration and disability was most marked in the control patients. Despite recent hospitalizations, both men had continued to have symptoms and findings of progressive cardiac decompensation. On the other hand, the chronic, indurated edema and cardiomegaly of syphilitic subject #194 had not changed during the last seven years (and possibly not for nineteen years, as the comparison of findings by different examiners with each survey is difficult). The only notable change was the development of atrial fibrillation since the 1963 examination. The other syphilitic subject with AR (#329) had been asymptomatic for the past seven years (1963-1970), although he had previous cardiopulmonary symptoms (1952 and 1958). Both syphilitic subjects had received penicillin two decades prior, following which VDRL reactivity results decreased in both.

Data derived from review of autopsy records are presented in Table II. Evidence of aortitis by both gross and microscopic examination according to established criteria (6) have been demonstrated much more frequently in syphilitics than controls, 44.3 versus 14.8 percent. Also, the incidence of a normal aortic arch pathologically has been significantly greater in control subjects, 61.1 versus 27.1 percent ( $P = 0.005$ ). However, there was no significant difference of focal myocardial scarring or infarction demonstrated between the syphilitic and control groups, 34.3 versus 37.0 percent with both gross and microscopic evidence and 25.0 versus 31.5 percent with neither ( $P = 0.25$ ).  $(P=0.0005)$  should be  $(P \leq 0.005)$   $(P=0.25)$  " "  $(P \geq 0.25)$

Twenty-five (33 percent) of the 76 syphilitics who were blood tested had nonreactive results by nontreponemal testing (VDRL and Automated Reagins Tests), while all but one had reactive results by treponemal testing (FTA-ABS and TPI Tests). (That one subject, #480, had reactive results by TPI testing in 1952 and 1963 and nonreactive result in 1970. His FTA-ABS Test result, reactive in 1963, was also nonreactive in 1970.) None of the control patients had reactive results by either treponemal or nontreponemal testing.

#### Discussion

Syphilis in its early clinical stages is no longer the dread disease that it was as the Great Pox in the Middle Ages. Rupial or malignant secondary syphilis is a rare disease today. On the other hand, observations from the Oslo Study, the Yale University Studies (5) and those previously reported from this study (6-12) have shown that infections with T. pallidum in untreated patients could result in considerable late destructive complications and threaten life when involving the central nervous system or cardiovascular system. Reported findings from the earlier surveys of this study included the following observations: 1) The life expectancy of men found to have syphilis between the ages of 25 and 50 years was decreased by 20 percent. The death rates in syphilitics in this age span was 75 percent greater than that of controls. 2) Systolic and diastolic hypertension,

arteriosclerosis, and general morbidity were all more common in syphilitics than controls in all previous surveys. 3) In the first five year follow-up, cardiovascular disease in men under 40 years of age appeared in 25.3 percent of syphilitics as opposed to only 5.7 percent of controls. Aortitis as detected by fluoroscopy was present in 23.6 percent of the syphilitics versus five percent of the controls. 4) Of the 125 autopsied subjects reported in 1955, 50 (57.5 percent) of the syphilitics had either macroscopic or microscopic evidence of aortitis (87 aortas thoroughly examined). Of those autopsied, 28 (30.4 percent) of the 92 syphilitic patients had cardiovascular or central nervous system syphilitic lesions as their primary cause of death.

For the first time since the inception of this study, no significant disparity of cardiovascular morbidity was demonstrated between the syphilitic and control populations in 1968-1970. Thus, at this late phase in the study, the clinical manifestations of syphilis appear to have fully exerted themselves. The only remaining evidence of the increased mortality of syphilis is that revealed by the composition of the surviving study population. Seventeen percent of the original syphilitics were seen in 1968-70 as compared to 27 percent of the control population.

One of the first clinical uses of penicillin was the treatment of all stages of syphilis. Despite some recent reports of persisting viable spiral forms following adequate treatment of syphilis (13, 14), *T. pallidum* has remained as sensitive to penicillin as it was initially. For many years, benzathine penicillin has been the advised treatment for all stages of syphilis, as long lasting serum levels of penicillin are considered necessary for optimal spirochetocidal effect (15). Schroeter and others (16) have recently demonstrated that short acting penicillin (procaine penicillin G), when given in sufficient doses to obtain high blood levels for gonorrhea treatment, has successfully aborted (<sup>incubating</sup> ~~clinical~~) disease in contacts to early syphilis. Thus, perhaps even small doses of short acting penicillins can prevent further tissue destruction of syphilis. In this age of widespread penicillin and antibiotic usage, it is seldom that a person can live 25 years without receiving

one of these effective drugs. Following the introduction of penicillin, only one of the Tuskegee syphilitics has apparently received no treatment. Thus, not only the duration of the study but also the effects of antimicrobial therapy probably accounted for the lack of morbidity in the 1960-1961 survey.

Our most unexpected observation during this survey was the detection of aortic regurgitation in two control patients clinically indistinguishable from the AR of two subjects with treated syphilis. Although one of the two control patients had previously had gonorrhea, at no time was there any clinical evidence of syphilis in either of the patients and their serum nonreactivity by varied methods of syphilis testing has persisted. Although gonococcal endocarditis and subsequent AR could have occurred in subject #603, the long course of documented hypertension was more related temporally to the late appearance of aortic regurgitation. The cause of valvular disease in patient #405 is unclear. Presumably his disease could have resulted from syphilitic degeneration of the valve (17), bacterial endocarditis on a bicuspid aortic valve (18), or other undetermined causes, such as rheumatic heart disease. Our observation of clinical improvement of one patient (#329) with syphilitic AR plus stabilization of disease in the other (#124) following penicillin treatment suggests that specific antimicrobial therapy of late disease may still be beneficial. Certainly both subjects have far outlived the three years' longevity prognosticated for untreated patients with such disease (19). Although others feel differently (19), withholding penicillin treatment from such patients probably cannot be justified by the argument that repair of already existing destruction would be minimal compared to the risk of Jarisch-Herxheimer reactions of fever, angina, or rupture of aneurysm. The importance of such reactions in this form of late syphilis is certainly debatable (20). Therefore, in such cases we suggest that antibiotic therapy be recommended in addition to supportive therapeutic measures such as digitalis, diuretics, salt restriction, and other measures to counter the resulting congestive heart failure.

Barondess and Sando (3) have recently observed that aortic regurgitation

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resulting from syphilis was associated with a significantly higher incidence of ischemic myocardial changes at autopsy when compared to that of age-matched patients with AR of rheumatic heart disease. In reviewing the autopsy records of this study, we have noted the pathologic findings of aortitis were more frequent in syphilitics as expected, but associated ischemic myocardial changes were no more frequent. Syphilitic involvement of coronary artery ostia, according to this study, has not resulted in increased myocardial scarring. The cumulative decreasing incidence of aortic arch pathology with time suggests that those who had severe involvement died within the first decades of the study. In recent years, aortitis has been demonstrated infrequently in the elderly syphilitics at postmortem examination, thereby accounting for a drop in the overall incidence of such pathology from 58 to 44 percent in the last 15 years. These figures also approach those of the Oslo and Yale University Studies. Race, therefore, does not appear to influence the longevity of patients with untreated syphilis. In the Yale University autopsy series, the only study in which both major races of this country were compared, syphilitic lesions of all organ systems were four times more frequent in Negroes, but the risk of death due to syphilis was no greater than that for syphilitic Caucasians (5).

As observed previously by Rockwell (12), again the treponemal tests (FTA-ABS and TPI Tests) have shown enhanced confirmation of treated or untreated latent disease. However, as the course of the two patients with syphilitic AR demonstrated, the quantitative nontreponemal blood test (VDRL Test) was more valuable for following patients after treatment.

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References

- 1) Proffitt, TM: Syphilitic Aortic Insufficiency. JAMA 211:637-639, 1970.
- 2) Friedman, B: Syphilitic Aortic Insufficiency. Alabama Journal of Medical Sciences 6:3-17, 1969.
- 3) Barchess, JA and Sande, M: Some Changing Aspects of Aortic Regurgitation: An Autopsy Study. Transactions of the American Clinical and Climatological Association 80:23-36, 1968.
- 4) Clark, EG and Danbolt, H: The Oslo Study of the Natural History of Untreated Syphilis. Journal of Chronic Diseases 2:311-344, 1955.
- 5) Rosahn, PD: Autopsy Studies in Syphilis. Journal of Venereal Disease Information 28:Supplement No. 21, 1947.
- 6) Peters, JJ, Peers, JM, Olansky, S, Cutler, JC, and Gleeson, CA: Untreated Syphilis in the Male Negro. Journal of Chronic Diseases 1:127-143, 1955.
- 7) Vonderich, RA, Clark, T, Sonner, CC, and Heller, JR, Jr.: Untreated Syphilis in the Male Negro. Journal of Venereal Disease Information 17:1-7, 1936.
- 8) Heller, JR and Bruyere, PT: Untreated Syphilis in the Male Negro II. Journal of Venereal Disease Information 27:2-7, 1946.
- 9) Deibert, AV and Bruyere, MC: Untreated Syphilis in the Male Negro III. Journal of Venereal Disease Information 27:301-314, 1946.
- 10) Olansky, S, Harris, A, Cutler, JC, and Price, EV: Untreated Syphilis in the Male Negro. Archives of Dermatology 73:516-522, 1956.
- 11) Olansky, S., Schuman, SH, Peters, JJ, Smith, CA, and Rombo, DS: Untreated Syphilis in the Male Negro. Journal of Chronic Diseases 4:177-185, 1956.
- 12) Rockwell, DH, Yobs, AR, and Moore, MB, Jr.: The Tuskegee Study of Untreated Syphilis. Archives of Internal Medicine 114:702-708, 1964.
- 13) Smith, JE: Late Ocular Syphilis: Transfer of Infection from Man to Experimental Animals. Trans Amer Ophthalm Soc 67:653-57, 1969.
- 14) Hardy, JB, Hardy, PH, Oppenheimer, EH, and Ryan, SJ: Failure of Penicillin in a Newborn with Congenital Syphilis. JAMA 212:1345-1349, 1970.

15. Magic, H and Magnuson, MJ: The Effect of the Method of Administration on the Therapeutic Efficacy of Sodium Penicillin in Experimental Syphilis. Bull. Johns Hopkins Hosp. 79:160, 1946.
16. Schroeter, AL, Turner, RM, Lucas, JB, and Brown, WJ: Therapy for Incubating Syphilis, Effectiveness of Gonorrhea Treatment. JAMA 218:711-713, 1971.
17. Aslam, PA, Eastridge, CB, Bernhardt, E, and Pate, JW: Myxomatous Degeneration of Cardiac Valves. Chest 57:535-539, 1970.
18. Roberts, WC: Anatomically Isolated Aortic Valvular Disease. Amer. J. Med. 49: 151-159, 1970.
19. Kampmeier, RH: The Late Manifestations of Syphilis: Skeletal, Visceral, and Cardiovascular. Med. Clinics of N.A. 48:667-697, 1964.
20. Hughes, GR: Jarisch-Herxheimer Reaction and Syphilitic Aortitis. Brit. med. J. 1:360, 1963.

Figure 1. Selected electrocardiographic leads from patients with AR. Record of #603 (upper left) shows little change with persistent anterolateral ischemia. Only one record of #495 (upper right) shows left ventricular hypertrophy (LV). Recordings from #194 (lower left) demonstrate development of atrial fibrillation and premature ventricular contractions in the last record, in addition to previous LVH and progressive development of anterolateral ischemia. Records of #329 (lower right) show no change over the past 12 years.

Figure 2. External pulse recordings and phonocardiograms of patients with AR. Consistent with AR is the carotid pulse recording of #603 (upper left) with upstroke time (UT) of 0.03 sec. and shortened ejection time (ET) of 0.26 sec. Lower left sternal border (LLSB) phonocardiogram demonstrates a short early diastolic decrescendo murmur (DM), barely detectable at this time, and a high frequency mid-cystolic murmur (SM). (left?)

The systolic bulge in apexcardiogram (ACG) of #495 (upper right) probably represents left ventricular (LV) dysfunction. Phonocardiography illustrates a high frequency holodiastolic murmur of AR at the base and a low frequency holodiastolic Austin-Flint murmur at the apex.

For subject #194 (lower left), the UT is prolonged (0.22 sec.) with normal ET. The apexcardiogram shows a late systolic bulge consistent with LV dysfunction. Phonocardiogram shows an early midsystolic murmur of high frequency at the LLSB; decrescendo, high frequency diastolic murmur at the LLSB; and diastolic rumble of the Austin-Flint murmur at the apex.

UT and ET of #329 (lower right) are normal. A late systolic force accentuation of the apexcardiogram is consistent with LV dysfunction. The early midsystolic murmur with high and low frequency at the apex; an apical, low frequency ventricular gallop ( $S_3$ ); and a high frequency decrescendo diastolic murmur loudest at the upper left sternal border (ULSB) probably represent mitral valve and LV dysfunction and AR.

Figure 3. PA chest x-rays of subjects with AR. The widened aortic root shows no difference in configuration between the controls #603 and 495 (upper x-rays, left and right respectively) and syphilitic subjects #194 and 329 (lower x-rays, left and right).

Table I. Clinical histories of the four patients with AR. Number 194 was originally selected as a syphilitic subject, while #329 was a control who later acquired syphilis. Number 603 and #495 were originally control subjects and have continued as such throughout the study. (KRP refers to Kolmer Reiter Protein Test; AR Test, Automated Reagin Test; NR, nonreactive; R, reactive.)

Table II. Ascending aortic and myocardial pathologic abnormalities at postmortem examinations of study subjects.

DATE (AGE)	CLINICAL NOTES	BLOOD PRESSURE	CARDIOPULMONARY RATIO	SEROLOGIC TEST RESULTS	ANTIDIURATIC TREATMENT
		(mm Hg)			
1964 (35)	none	120/80	42%	Kassermann NR Kahn NR	—
1969	hospitalized 4 weeks for "slow leak of heart"				
Interval, 1969-1970	dyspnoea, palpitations, pedal edema, chest pain with effort				
1970 (72)	water-hammer pulse, pulsus alternans, 3/6 AI, cardioegaly, LV heave, capillary pulsations, head-nod, dependent edema	208/88	62%	VDRL FTA-ABS TP1	NR NR NR

Table I. Subject #603

DATE (AGE)	CLINICAL NOTES	BLOOD PRESSURE	CARDIOTHORACIC RATIO	SEROLOGIC TEST RESULTS	ANTILUPTIC TREATMENT
1914	gonorrhea (GC)				--
1925	GC and ? arthritis				--
1934 (40)	none	115/80	50%	Wassermann NR Kahn NR	--
1938 (45)	none	120/84	50%	Kline NR Kahn NR	--
1946(55)	dyspnea with exertion	139/82	50%	Kahn NR Kolmer NR Eagle NR	--
1952 (58)	dyspnea and palpitations	175/130	58%	VDRL NR Kahn NR TPI NR	--
1958 (63)	same	185/110	55%	battery of ten tests, all NR	--
1963 (68)	same	235/128	54%	VDRL NR KRP NR TPI NR FTA NR	--
1965 (70)	same, edema +1	170/98	--	VDRL NR TPI NR FTA-ABS NR	--
1968	hospitalized 2 weeks for hypertension and congestive heart failure				
1969	hospitalized 1 week for congestive heart failure				
1970 (75)	angina pectoris, dyspnea with slight effort, edema, cardiomegaly, 3/6 AR	190/92	60%	VDRL NR FTA-ABS NR TPI NR AR Test NR	--

Table I. Subject #529

DATE (AGE)	CLINICAL NOTES	BLOOD PRESSURE	CARDIOTHORACIC RATIO	SEROLOGIC TEST RESULTS	ANTIMALARIAL TREATMENT	
					TOBE	TRIMETHINE
1953	gonorrhoea					
1954 (26)	none	125/80	56%	Wassermann NR Kahn NR	--	
unknown	chancre					
1946 (40)	cardiac palpitations; "aortic murmur" 120/70		56%	Kahn Kolmer	R, 3+ R, 4+	--
1950					penicillin, daily injections for 2	
1952 (45)	moderate dyspnea with 142/88 exertion; orthopnea; palpitations; "aortic murmur"		57%	VDRL Kahn	R, 1:28 R, 3+	--
1958 (51)	slight dyspnea 142/80		52%	VDRL	R, 1:1	--
1963 (56)	AR, 2/6	130/85	49%	VDRL FTA TPI	WR R R	--
1968 (60)	asymptomatic; 138/74 AR, 3/6		--	VDRL FTA-Abs TPI	NR R R	--
1970 (62)	asymptomatic; 132/77 AR, 3/6		50%	--		--

Table I. Subject #1914

DATE (AGE)	CLINICAL NOTES	BLOOD PRESSURE	CARDIOTHORACIC RATIO	SEROLOGIC TEST RESULTS	ANTIGLOBULINS TEST RESULTS
1932	chancroid				
1934	chancroid				
1933 (49)	none	116/83	50%	Wassermann, R, Kahn R, R, R	--
1938 (54)	aortic sys- tolic murmur; moderate dilatation of ascending aorta by fluoroscopy	96/70	58%	Kline	R, 1: --
1948 (64)	aortic regurgi- tation (AR) and aortic stenosis (AS) murmurs	110/55	58%	Eagle	R, 1:128 --
1952 (67)	AR & AS	--	60%	VDRL Kahn	R, 1:128 -- R, 1:256
1954					penicillin, daily injections for 2 wks
1958 (73)	dyspnea with exertion; AR & AS	13 $\frac{1}{4}$ /74	59%	VDRL Kahn Kolmer	R, 1:16 -- R, 1:64 R, 1:32
1963 (79)	dependent edema; AR & AS	215/92	65%	--	--
1966 (82)	same	160/60	--	VDRL FTA-ABS TPH	R, 1:2 -- R R
1968 (84)	same; 4/6 AR 192/77 and 2/6 AS	--		VDRL FTA-ABS TPH	R, 1:2 -- R R
1970 (86)	same	210/72	60%	VDRL FTA-ABS AR Test	R, 1:2 -- R R, 1:4

TABLE II. AORTIC ARCH AND MYOCARDIAL ABNORMALITIES AT AUTOPSY  
(194 subjects with complete information)

ABNORMALITY OF MYOCARDIUM DETECTED BY:	ABNORMALITY OF ASCENDING AORTA DETECTED BY:							
	Both Gross and Micro. Exam.		One or the Other		Neither		Total	
	Number	Percent	Number	Percent	Number	Percent	Number	Percent
<u>SYPHILITICS (140)</u>								
Both Gross and Micro. Exam.	21	15.0	18	12.9	9	6.4	48	34.3
One or the Other	31	22.1	12	8.6	14	10.0	57	40.7
Neither	10	7.1	10	7.1	15	10.7	35	25.0
Total	62	44.3	40	28.6	38	27.1	140	100.0
<u>CONTROLS (54)</u>								
Both Gross and Micro. Exam.	5	9.3	5	9.3	10	18.5	20	37.0
One or the Other	3	5.6	5	9.3	9	16.7	17	31.5
Neither	0	0.0	3	5.6	14	25.9	17	31.5
Total	8	14.8	13	24.1	33	61.1	54	100.0

Note:

When the distribution of cases by results of gross and microscopic examination of the aorta for the syphilitic and the controls were compared, a significant difference was found between the two groups.

$$(X^2 = 20.09, \text{ for } X^2 \text{ with 2df. } P = <.005)$$

In a similar comparison of the examinations of the myocardium, no significant difference was found between the two groups.

$$(X^2 = 2.02, \text{ for } X^2 \text{ with 2df. } P = >.25)$$